

METHOD AND APPARATUS FOR ACTIVATING FREQUENCIES IN WHITE SPACE

TECHNOLOGICAL FIELD

[0001] An example embodiment relates to the field of wireless mobile communications, more particularly, gaining additional resources for networking in the time and frequency domains from white spaces in the mobile spectrum.

BACKGROUND

[0002] The 3GPP Long Term Evolution (LTE) technology is expected to expand to new spectrum, which may operate according to the principles of coexistence on White Spaces (that is, largely unused frequency bands). Currently, for example, the mechanisms for coexistence on television spectrum white spaces are being standardized in IEEE 802.19.1 (for example for the use of 802.11af).

[0003] LTE operation on white spaces spectrum requires procedures whose requirements are defined for white spaces operation; that is, procedures required for coexistence between radios on white spaces and procedures to use LTE carriers on white spaces. The problems are numerous, originating from poor coordination of these procedures, duplication of functionality due to the intended use of different spectrum, lack of definitions of security and authentication, high latency of procedures, possible unreliability of procedures due to the characteristics of the white spaces spectrum and heavy requirements for a user device to act frequently on multiple frequencies already at times when the actual data transfer and use of spectrum resources does not yet take place.

BRIEF SUMMARY

[0004] A first embodiment is a method to get additional resources for network use from white spaces spectrum. The method may provide the white spaces signaling such as in the licensed spectrum, and hence minimize the effort of transmitting and receiving the enabling handshakes on the white spaces frequencies. In one embodiment, exchange of coded signaling on white spaces frequencies can be avoided, and sequence handshake is sufficient because of the availability of radio resource control (RRC) signaling via the network, such as an LTE network. Once the use of white spaces is enabled, they become quickly available for the actual transmission and reception of transport blocks. Enabling and further keeping the white spaces enabled is handled by minimum signaling on the white spaces, while the control of configurations, timing, security and authorizations are handled by the network, such as by signaling within the licensed spectrum.

[0005] One embodiment is a method comprising acquiring spectral resources beyond the licensed spectrum for a wireless network from available white spaces spectrum and identifying a carrier aggregation configuration of available white space frequencies using network signaling in the licensed spectrum. The method may further comprise causing the carrier aggregation configuration of available white space frequencies to be signaled in a radio resource control (RRC) message, with the RRC white space carrier aggregation configuration message being at least partially encrypted or ciphered and integrity protected to avoid fraudulent use of white spaces enablers. The method of one embodiment comprises the network entity signaling an enabling sequence with the carrier aggregation configuration message for receivers to

be informed of one sequence to search for enabling signals, and changing key sequences used to encode the enabling sequences to create a trail of sequences to protect the enabling sequences from fraudulent capture.

[0006] The method of one embodiment further comprises enabling white space communications using an interactive handshake sequence. The handshake sequence of this embodiment comprises causing at least one enabling signal to be transmitted from a network entity to indicate the availability of one or more white spaces for wireless network communications, receiving at a wireless network entity at least one enabling request for one or more white spaces requesting activation of those white spaces for network communication, and causing an enabling response to be transmitted via network signaling in the licensed spectrum including each white space frequency to be activated in response to the enabling request or, alternatively, activating the requested white space frequencies by causing an LTE Medium Access Control protocol Control Element (MAC CE) signal to be transmitted identifying the frequency list to be activated. The method of one embodiment further comprises activating the requested white space frequencies via an RRC message.

[0007] Another embodiment may be an apparatus comprising at least a processor and at least one memory including computer code arranged to, with the processor, cause the apparatus at least to acquire spectral resources beyond the licensed spectrum wireless network communications from available white spaces spectrum and identifying a carrier aggregation configuration of available white space frequencies using network signaling in the licensed spectrum. The processor, memory and computer code further cause the apparatus of one embodiment to enable white space communication using an interactive handshake sequence, wherein the apparatus causes an enabling signal to be transmitted to indicate the availability of one or more white spaces for wireless network communications, receives at a wireless network entity an enabling request for one or more white spaces requesting activation of those white spaces for network communications, and causes an enabling response to be transmitted via network signaling in the licensed spectrum including each white space to be activated in response to the enabling request, or activates the requested white space frequencies by transmitting an LTE Medium Access Control protocol Control Element (MAC CE) signal identifying the frequency list to be activated. In preparation for the handshake sequence the apparatus causes a wireless network entity to access a geolocation database for a list of available white space frequencies, causes the carrier aggregation configuration of available white space frequencies to be signaled in a radio resource control (RRC) message and at least partially encrypt and integrity protect the RRC white space carrier aggregation configuration message to avoid fraudulent use of white spaces enablers. The processor, memory and computer code may further cause the apparatus to cause an enabling sequence to be signaled with the carrier aggregation configuration message for receivers to be informed of one sequence to search for enabling signals, and to change key sequences used to encode the enabling sequences to create a trail of sequences to protect the enabling sequences from fraudulent capture.

[0008] Another embodiment may be a computer program product comprising a computer-readable medium having computer code instructions stored therein, wherein the instructions cause a network wireless entity to at least acquire spectral resources beyond the licensed spectrum for wireless